# Electrochemical ascorbic acid sensor based on DMF-exfoliated graphene

Gareth P. Keeley, Arlene O'Neill, Niall McEvoy, Nikos Peltekis, Jonathan N. Coleman, Georg S. Duesberg

Supplementary Information

Electrode Design
The working electrode design used in these experiments consisted of two pieces, which were held together by four stainless steel screws. When assembled, it had dimensions of $22 \times 22 \times 5$ millimetres. Fig. SI_1 shows the design.
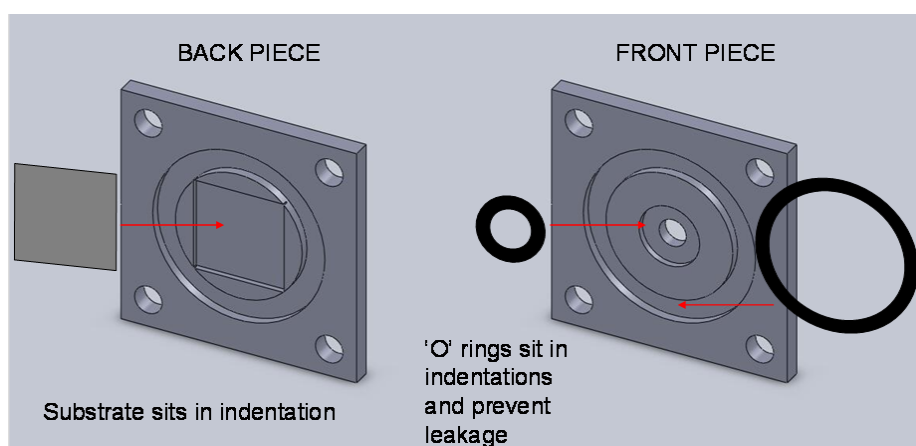
**SI_1.** Novel electrode design for electrochemical studies of pyrolysed photoresist films.

The pyrolysed photoresist films were held in an indentation in the back piece. A platinum wire, in a loop between the two nitrile 'O' rings, made the electrical contact to the films. The smaller of these two rings defined the electrode surface area as a disc of radius 1.5 mm, and they prevented the entry of electrolyte during experiments. Fig. SI_2 shows a cross-section of the assembled electrode.
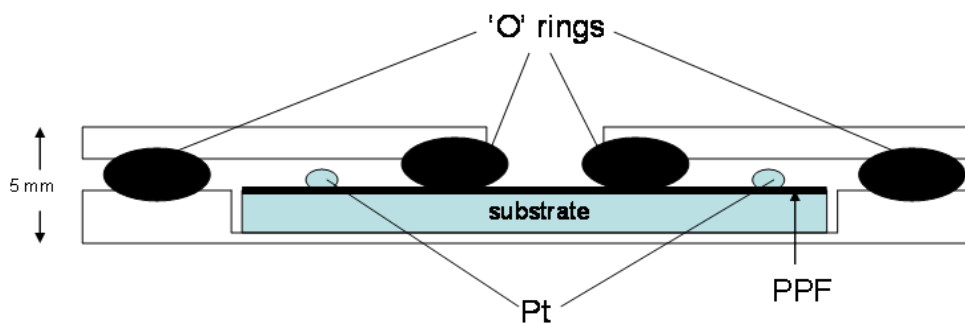
SI_2. Cross-section of the assembled working electrode.

## Statistical TEM Analysis of Graphene Nano-sheet Thickness

A statistical TEM analysis was employed to estimate the typical thicknesses of the exfoliated GNSs used in this work. A drop of the dispersion was placed on a holey carbon grid. By zooming in on the edges of one hundred arbitrary flakes, the identification of strata permitted the estimation of the number of layers in each sheet. This was not always possible for some multi-layers, so grey scales were used to compare flakes within the image. Fig. SI_3 shows a representation of the observed distribution. It was found that ~ 90% of the graphene nano-sheets had five or fewer layers, and the mean layer number per flake was four.
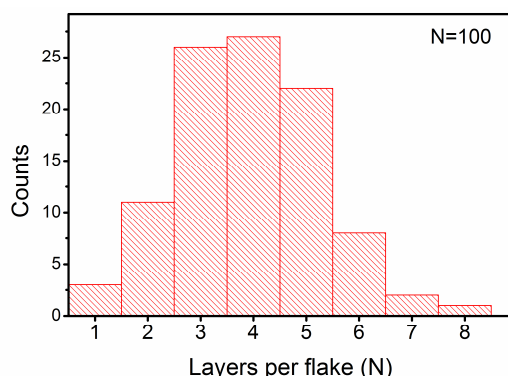
SI_3. Thickness distribution for one hundred arbitrary graphene nano-sheets measured using TEM.

Stability of Ascorbic Acid Response at Modified Electrode

Twenty cycles were performed in ascorbic acid in order to test for deleterious effects due to adsorption processes. Fig. SI_4 shows a comparison between the first and twentieth voltammograms. It should be noted, for clarity, that the first scan is also included in Fig. 5 in the manuscript. It can be seen that there is no significant decrease in the peak current with continued cycling. However, a positive shift in peak potential is acknowledged, which may be due to adsorption and / or electrode passivation.
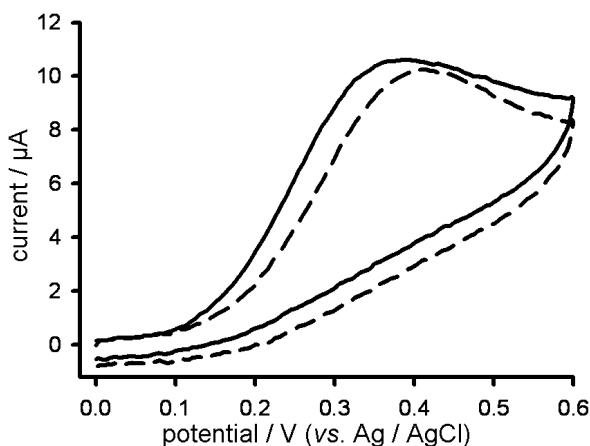
SI_4. The first (solid) and twentieth (dashed) cyclic voltammograms recorded at a GNS-modified PPF electrode in 1 mM ascorbic acid in 50 mM pH 7 phosphate buffer at a sweep rate of 100 mV s^{-1}.